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FUEL CELL

Examiner: Adam Arciero

S.N. 10/593,334

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October 21, 2009

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 6 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 6 recites "a composite layer that is disposed between the metal oxide layer composes the ceramic intermediate layer and a layer in contact with this metal oxide layer, and is formed with a mixture of the constituent components of the two adjacent layers." It is unclear to the Examiner what the second adjacent layer (other than the metal oxide layer) to the composite layer is and furthermore how the composite layer composes the ceramic intermediate layer and another layer in contact with the metal oxide layer. For the purposes of examination, the Examiner reads claim 6 as, "a composite layer that is disposed between the ceramic metal oxide layer and the metal intermediate layer and composes a metal in common with said ceramic layer

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and said metal layer, and is formed with a mixture of the constituent components of the two adjacent layers.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by SATO et al. (WO 2004/084333 A1 using corresponding US 2006/0141320 A1 for citation purposes).

As to Claim 1, SATO et al. discloses a fuel cell comprising a hydrogen-permeable metal layer containing a hydrogen-permeable metal such as a palladium-nickel alloy (pg. 1, [0012]), an electrolyte layer consisting of a metal oxide material which exhibits proton conductivity (pg. 1, [0009]), and a stress-relieving layer (intermediate layer) disposed between said hydrogen-permeable metal layer and said electrolyte layer, wherein said intermediate layer is composed of at least one metal layer which is the same as a metal element in common with said electrolyte layer (pg. 1-2, [0012]).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

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having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 2 and 5-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over SATO et al. (WO 2004/084333 A1, found in IDS using corresponding US 2006/0141320 A1 for citation purposes) in view of VAN BERKEL et al. (US 6,663,999 B2, found in IDS).

As to Claims 2 and 5, SATO et al. discloses a fuel cell comprising a hydrogen-permeable metal layer containing a hydrogen-permeable metal such as a palladium-nickel alloy (pg. 1, [0012]), an electrolyte layer consisting of a metal oxide material which exhibits proton conductivity (pg. 1, [0009]), and a stress-relieving layer (intermediate layer) disposed between said hydrogen-permeable metal layer and said electrolyte layer (Fig. 9 and paragraph [0108]), wherein said intermediate layer is composed of at least one metal layer which is the same as a metal element in common with said electrolyte layer (pg. 1-2, [0012]). SATO et al. does not specifically disclose a ceramic intermediate layer that is formed on the metal intermediate layer and is composed of at least one metal oxide layer.

However, VAN BERKEL et al. discloses a fuel cell comprising a nickel current collector layer (metal layer) 4, an intermediate layer comprising nickel 1, an electrolyte layer 3, and a ceramic intermediate layer 2 that is formed on the metal intermediate layer 1 and is composed of

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at least one metal oxide layer (col. 3, lines 29-54 and Fig. 1). Said ceramic intermediate layer comprises nickel and a ceramic material such as aluminum oxide (col. 3, lines 38-55). VAN BERKEL et al. further teaches that the ceramic intermediate layer and said electrolyte layer should comprise the same ion-conducting materials (col. 3, lines 44-55). At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the fuel cell of SATO et al. with a ceramic intermediate layer comprising nickel (metal in common with metal intermediate layer) and a ceramic comprising a metal oxide material which exhibits the same ion conductivity as SATO et al., because VAN BERKEL et al. teaches that a fuel cell assembly comprising such a structure allows the operating temperature of a solid oxide fuel cell to be reduced, which allows the fuel cell system to be constructed more cheaply (col. 1, line 66 to col. 2, line 8).

As to Claim 6, SATO et al. teaches the importance of forming mixed (composite) layers between adjacent layers composed of a mixture of the materials of the two adjacent layers so as to form a separation preventing mechanism (pg. 2, [0016]). Therefore, at the time of the invention, it would have been obvious to a person having ordinary skill in the art to modify the structure of SATO et al. and VAN BERKEL et al. by forming a mixed (composite) layer between the ceramic layer and the layers in contact with said ceramic layer, because SATO et al. teaches that the interfacial strength between said layers can be increases, and therefore separation decreased (pg. 2, [0016]).

9. Claims 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over SATO et al. (WO 2004/084333 A1 using corresponding US 2006/0141320 A1 for citation purposes) in view

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of VAN BERKEL et al. (US 6,663,999 B2 found in IDS) as applied to claims 2 and 5-6 above, and further in view of YAMAGUCHI et al. (Solid State Ionics, found in IDS dated 09/19/2006).

As to Claims 3-4, the combination of SATO et al. and VAN BERKEL et al. does not specifically disclose wherein the ceramic intermediate layer contains a higher percentage of a metal element in common with the electrolyte layer than said electrolyte layer. VAN BERKEL et al. teaches that Ceria is a common ceramic material to be used with the intermediate layers (col. 3, lines 50-55).

However, YAMAGUCHI et al. discloses a solid oxide fuel cell comprising a proton-conducting electrolyte such as $\text{BaCe}_{0.9}\text{Y}_{0.1}\text{O}_{2.95}$ (Abstract). At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the fuel cell of SATO et al. and VAN BERKEL et al. to comprise $\text{BaCe}_{0.9}\text{Y}_{0.1}\text{O}_{2.95}$ as an electrolyte, because YAMAGUCHI et al. discloses that the operation temperature can be reduced to intermediate temperatures (Introduction). The fuel cell of SATO et al. as modified by VAN BERKEL et al. and YAMAGUCHI et al. teaches a fuel cell wherein the ceramic intermediate layer contains a higher percentage of Ce than that of the electrolyte layer.

10. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over SATO et al. (WO 2004/084333 A1, found in IDS, using corresponding US 2006/0141320 A1 for citation purposes) in view of VAN BERKEL et al. (US 6,663,999 B2 found in IDS) as applied to claims 2 and 5-6 above, and further in view of CHAMPION US 2003/0235753 A1).

As to Claim 7, SATO et al. discloses a catalyzing layer disposed among the interfaces of the various layers between the hydrogen-permeable metal layer and the electrolyte layer (pg. 3,

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[0029]). SATO et al. does not specifically disclose wherein the catalyst layer comprises multiple pinholes.

However, CHAMPION teaches that catalyst for fuel cells are typically porous (pin-holes) (pg. 2, [0029]). At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the catalyst layer of SATO et al. so as to provide a rough/porous catalyst layer, because CHAMPION teaches that the surface area of the catalyst layer will be increased thereby increasing the amount of catalyst that can be exposed to hydrogen or oxygen (pg. 2, [0029]).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ADAM A. ARCIERO whose telephone number is (571)270-5116. The examiner can normally be reached on Monday to Friday 8am to 5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on 571-272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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AA

/Dah-Wei D. Yuan/
Supervisory Patent Examiner, Art Unit 1795